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Combining Hindu Philosophy and Scientific Concepts in a Children's Picture Book

For my Undergraduate Research Project, I worked on creating the basis of a children's picture book. The book aims to describe energy from both the biological science and Hindu philosophy perspectives. The target audience is students in grades 1-2. The initial goal of my project was to show that biological science and Hinduism do not need to be forced into agreement or disagreement and to promote tolerance by bringing these two schools of thought together pictorially. The resulting compilation of sketches and art demonstrates the clarity gained in the concepts depicted through the process of creating relevant art pieces.

In Hindu philosophy, *Prakriti* is the female energy embodied by the goddess Parvathy. It is the cause and symbol of all action that generates life. *Prakriti* is characterized by the experiences it delivers through the senses. The *Prakriti* energy is that which makes the world real through sensation. The art for the book aims to provide the sensations of sight, smell, taste, touch and sound. In the book, sunlight fuels the creation of sweet-smelling, tasty oranges whose flowers attract the buzzing bees. The female characters in the book dance together, thus generating touch, sound, and smell.

The book also aims to provide the reader a glimpse into the energy machines in a leaf at the level of the cell. The pictures depict the leaves receiving sunlight, a cross section of a dicot leaf and the chloroplasts inside the palisade mesophyll cells. A note on the cells found in a leaf, the role of chloroplasts in photosynthesis, and the flow of energy from the sun to leaf is found on the last page of the book. The book thus contains information about the inner structure of a leaf and the photosynthetic process.

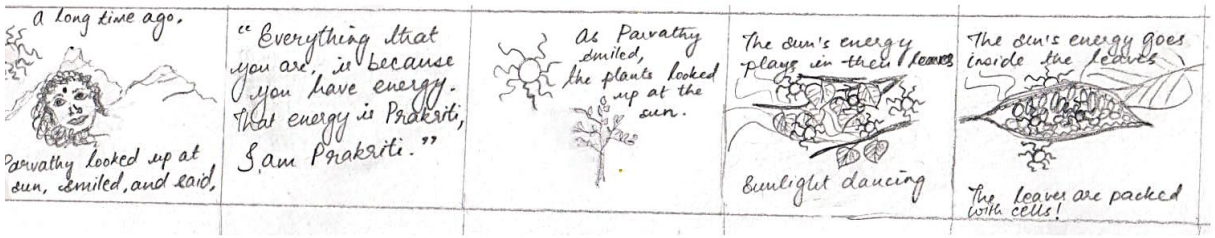
Thus, as *Prakriti* allows the reader to experience the taste, touch, smell and sounds in the book, the energy from photosynthesis fuels the production of the fruits and the dance. Together, *Prakriti* energy and energy from the sun build the experienced and observed world respectively.

The work compiled is in the following order: (a) Thumbnail art (b) Prose (c) Pen Sketches (d) Colour Studies (e) Science Note. The art work was done with black pen and watercolour.

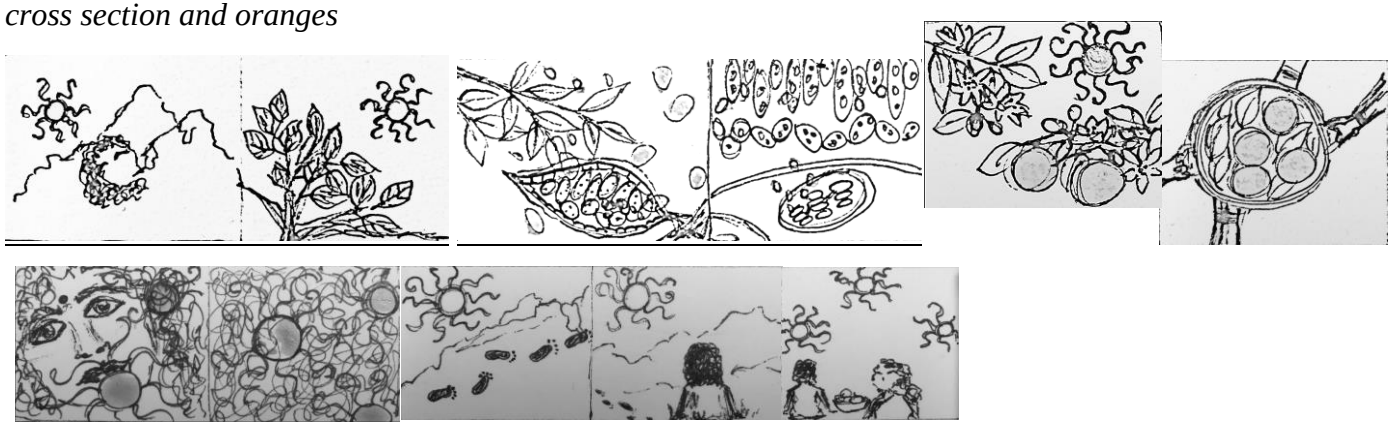
a. Thumbnail Art

These are miniature sketches of the final spreads of the book, indicating size and placement of text. The thumbnail sketches exposed gaps in flow of information, flat, lifeless drawings and informed the scaling to allow for text.

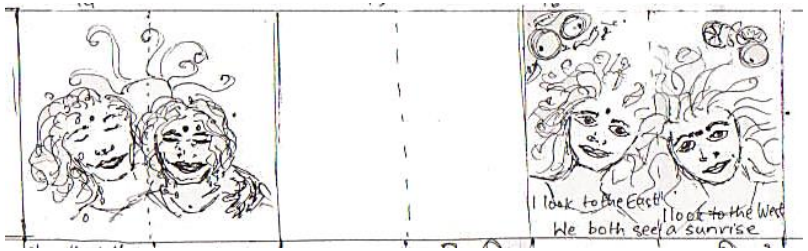
Set 1. Newly formed ideas about the nature of Prakriti and testing the level of scientific writing



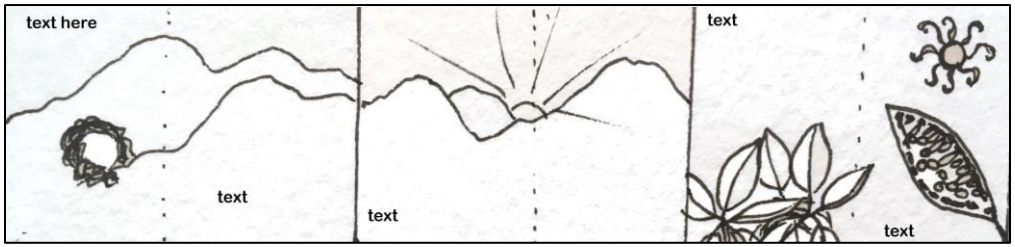
Set 2. Completion of a set beginning with Parvathy and ending in a group of unidentified female characters, introduction of the leaf cross section and oranges

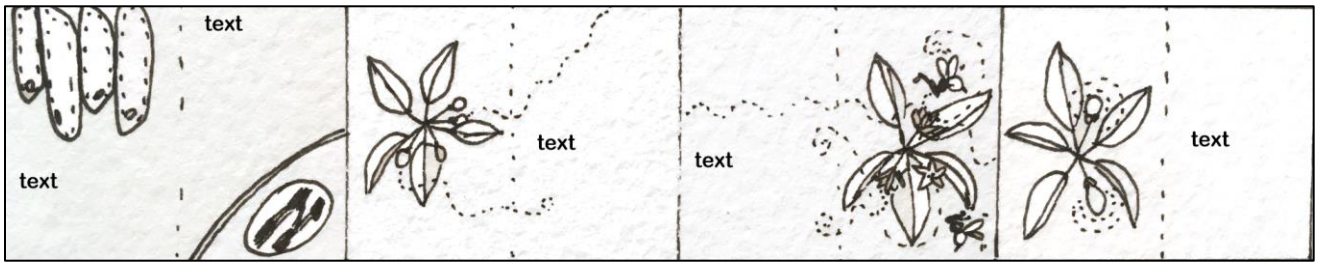


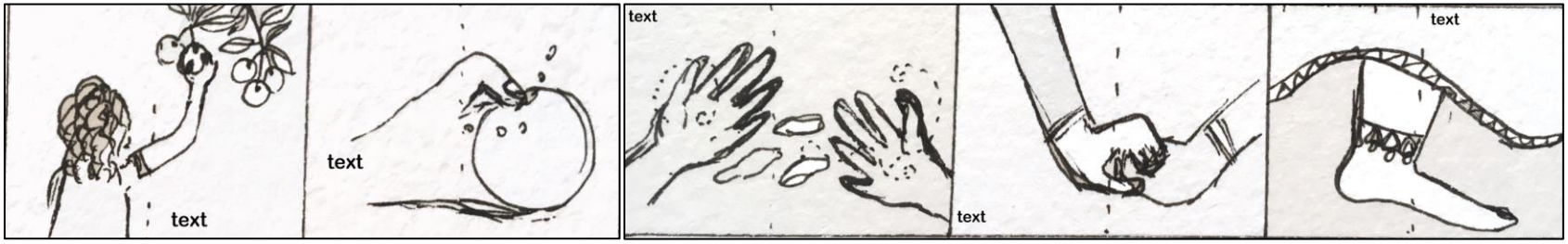
Set 3. Nearly complete set of sketches depicting a fuller storyline and the development of the oranges as a vehicle to show both photosynthesis and Prakriti

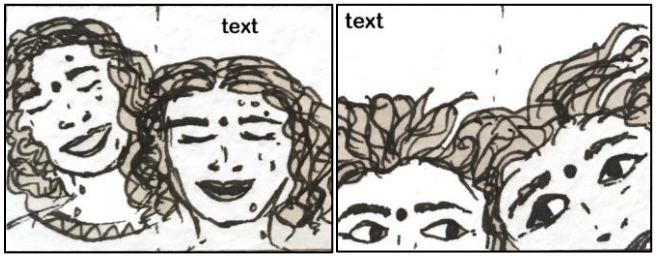


Set 4. Similar to Set.3 with the layout redone









Prose

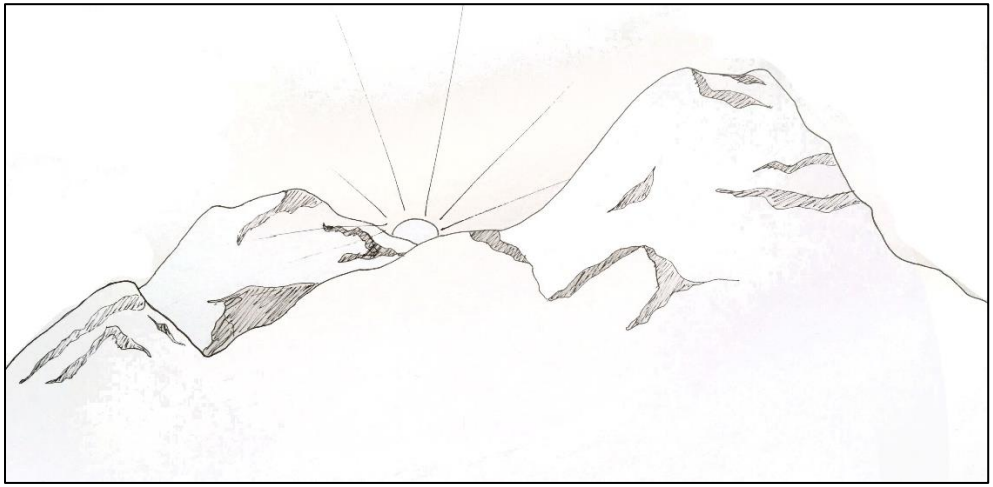
1. As Parvathy raised her gaze towards the rising sun, she said, “For the sweet sweat of the bees and laughing girls as they dance together…
2. …the sun and I are the sources of energy.”
3. Plants open their leaves to the warm sunlight that dances down from the sky. Look inside the leaf!
4. The leaves and the sunlight dance closer and closer to each other. The leaves use the sun’s energy to make sugar, and the plant uses the sugar…
5. … to make buds that bloom
6. …. into flowers as sweet as their nectar. The bees buzz and dance with the flowers, making music while they harvest nectar.
7. Silence while the flowers become fruits.
8. Oranges filled with energy look delicious in the sunlight
9. I pluck one and pierce its skin, juice comes flying out!
10. My hands smell sweet, I have bits of orange in my nails.
11. It’s time to dance!
12. Can you smell the orange and the sweat?
13. I can!
14. After we dance, we lay on the floor. I look to the East, she looks to the West. We both see a sunrise.

Energy thus begins in the book with *Prakriti. Prakriti*, symbolized by Parvathy is one of the sources of energy for the bees and dancing girls. Energy then shifts to that which the leaves capture from the sun. The sun’s energy is processed to make sugars that the plant uses to form the orange fruits. The prose used in the description of the fruit formation is sensory with the purpose to incorporate *Prakriti* as the sensory abstract energy that builds our perception of the world as ‘sweet’ or ‘fragrant.’ The oranges are used to shift from the biological energy cycle to purely sensory- eaten by a girl who then runs to dance with her friend. The dance generates touch, sound and smell. The book ends with the girls looking at each other and recognizing the sunrise, or *Prakriti*, in each other.

b. Pen sketches

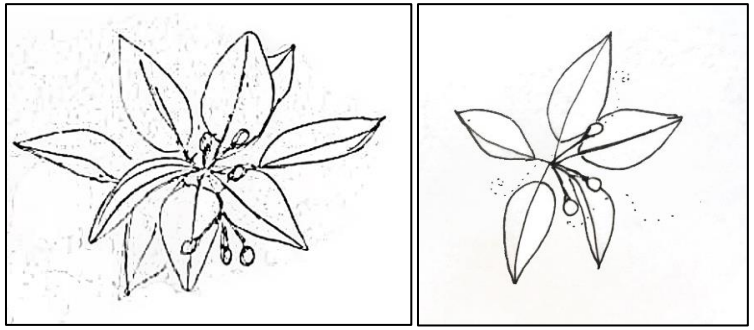
a. Parvathy looks to the East

b. Sunrise

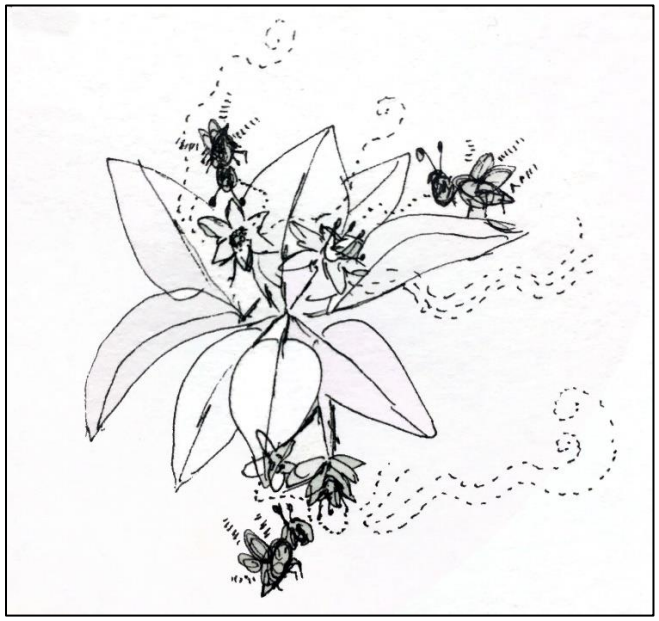


c. The stages of fruiting

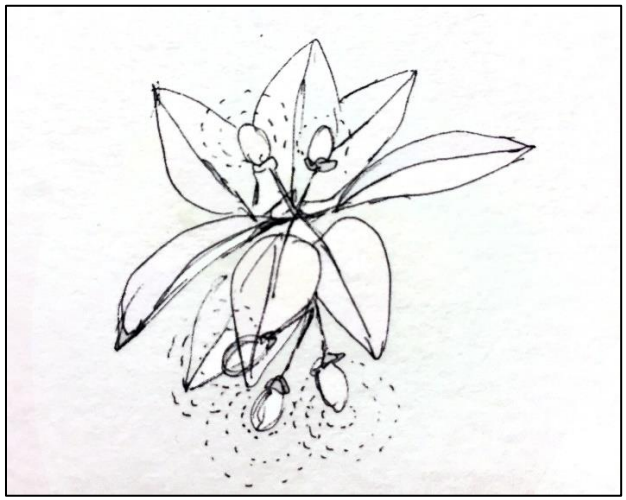
i. The buds on the orange tree



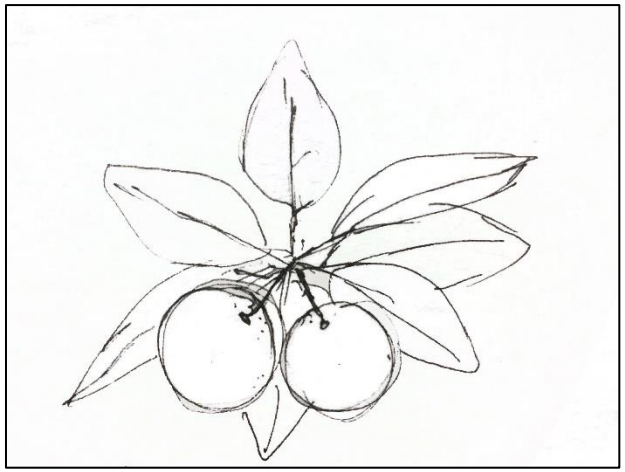
ii. The flowers with bees



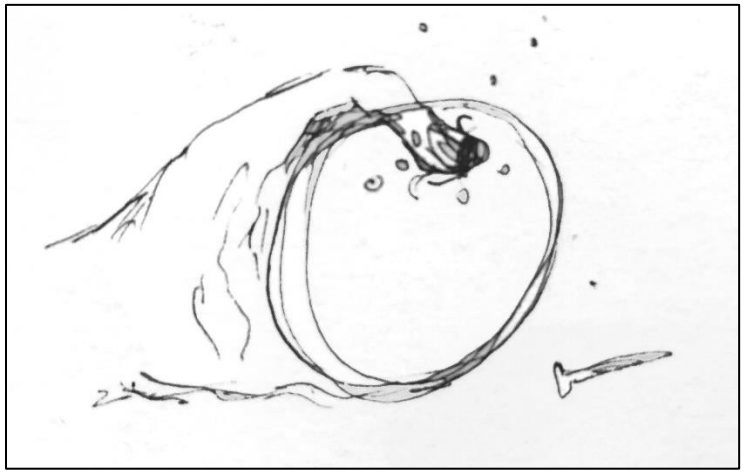
iii. The young fruit



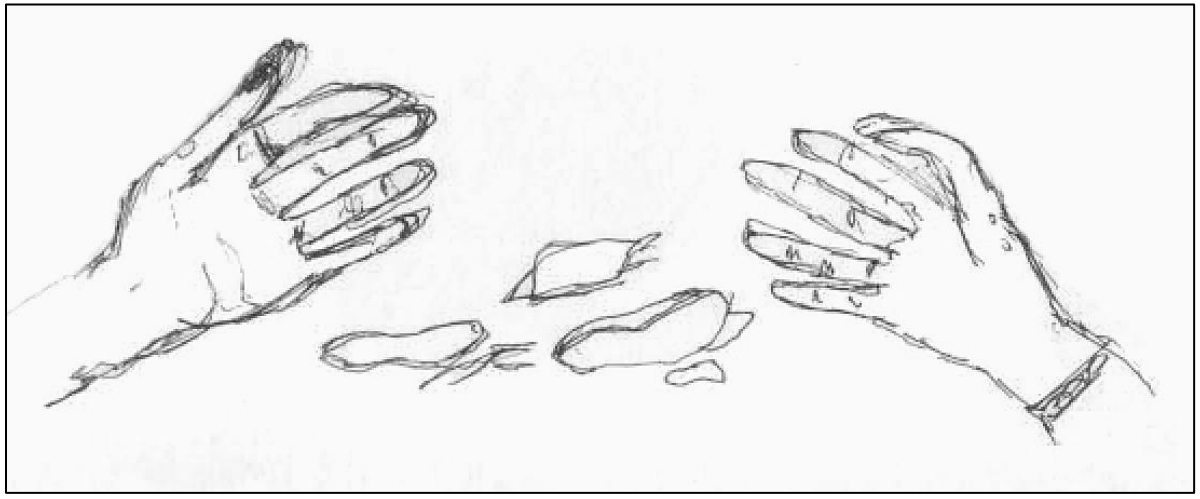
1. The oranges



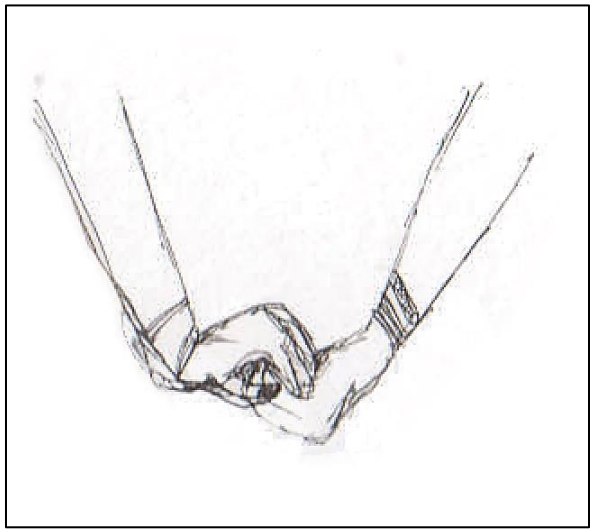
d. Hands interacting with the orange
    i. Piercing the skin



    ii. Sweet-smelling hands

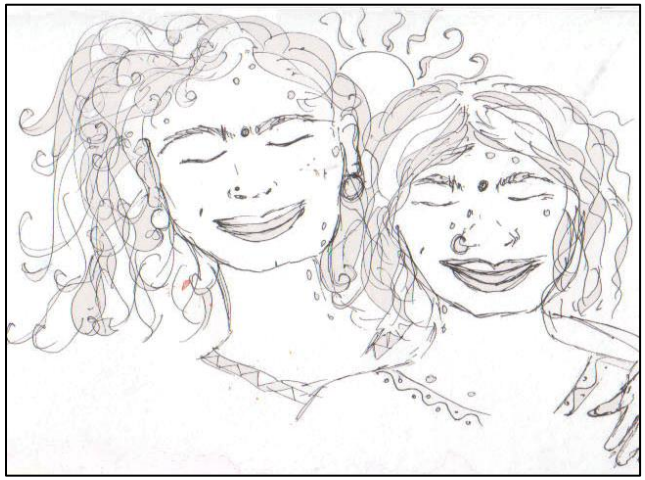


e. Girls dancing
    i. Holding hands



    ii. Running foot with an anklet

iii. The girls laughing and sweating



c. Colour Studies

a. Parvathy

This initial colour study showed the sun placed to the West above Parvathy's head. The sun was then moved out of the page to the next spread showing the sunrise in the East. The attention to detail thus created movement and meaning to the art.

i.

b. Sunrise

i.

ii.

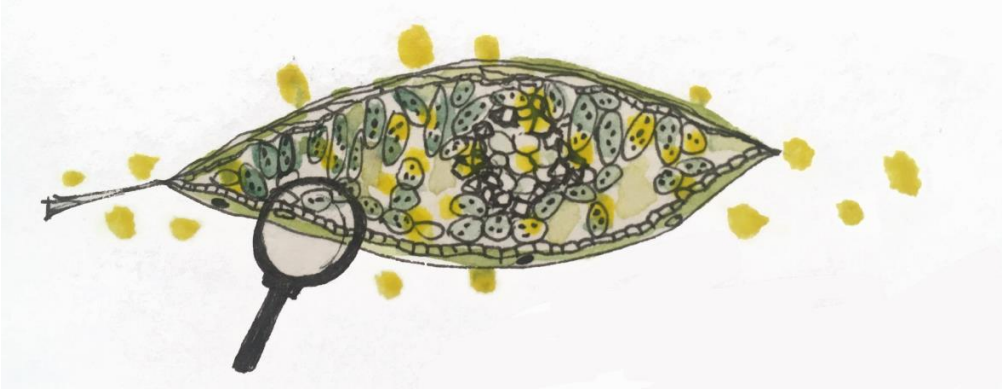
iii.

iv.

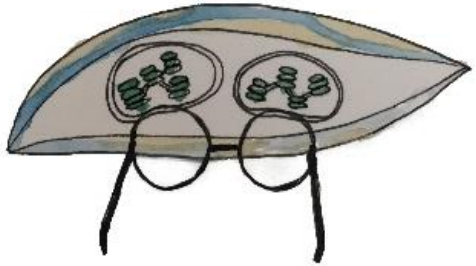
c. Leaves

i.

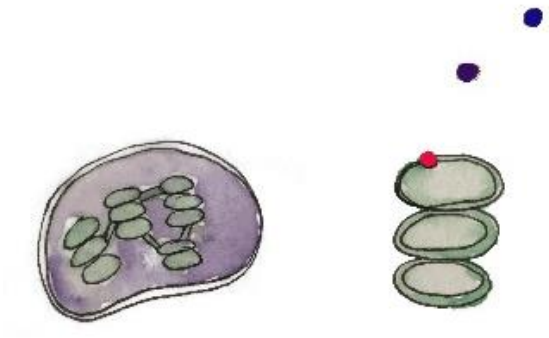
ii.



iii.



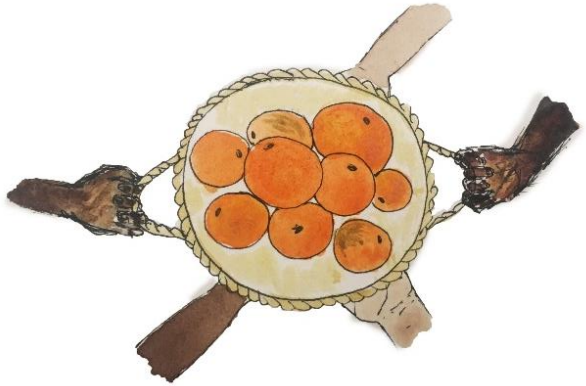
iv.



v.

d. Oranges

Sketches iii-v are depictions of the orange and its processing before consumption. While i. and ii. are pleasing to look at, they are flat and unrealistic, so were replaced with relatable, more vivid art.



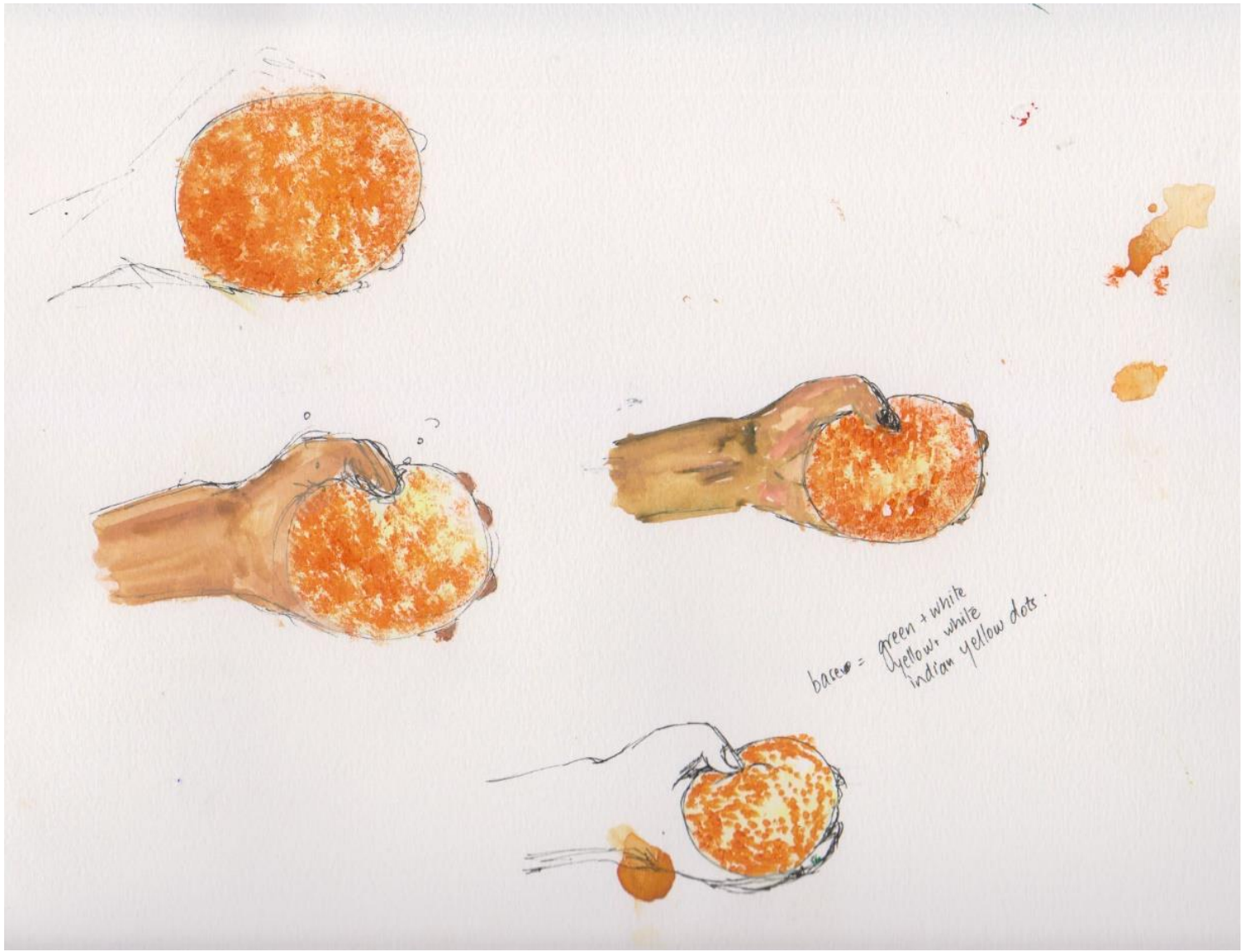
i.

ii.

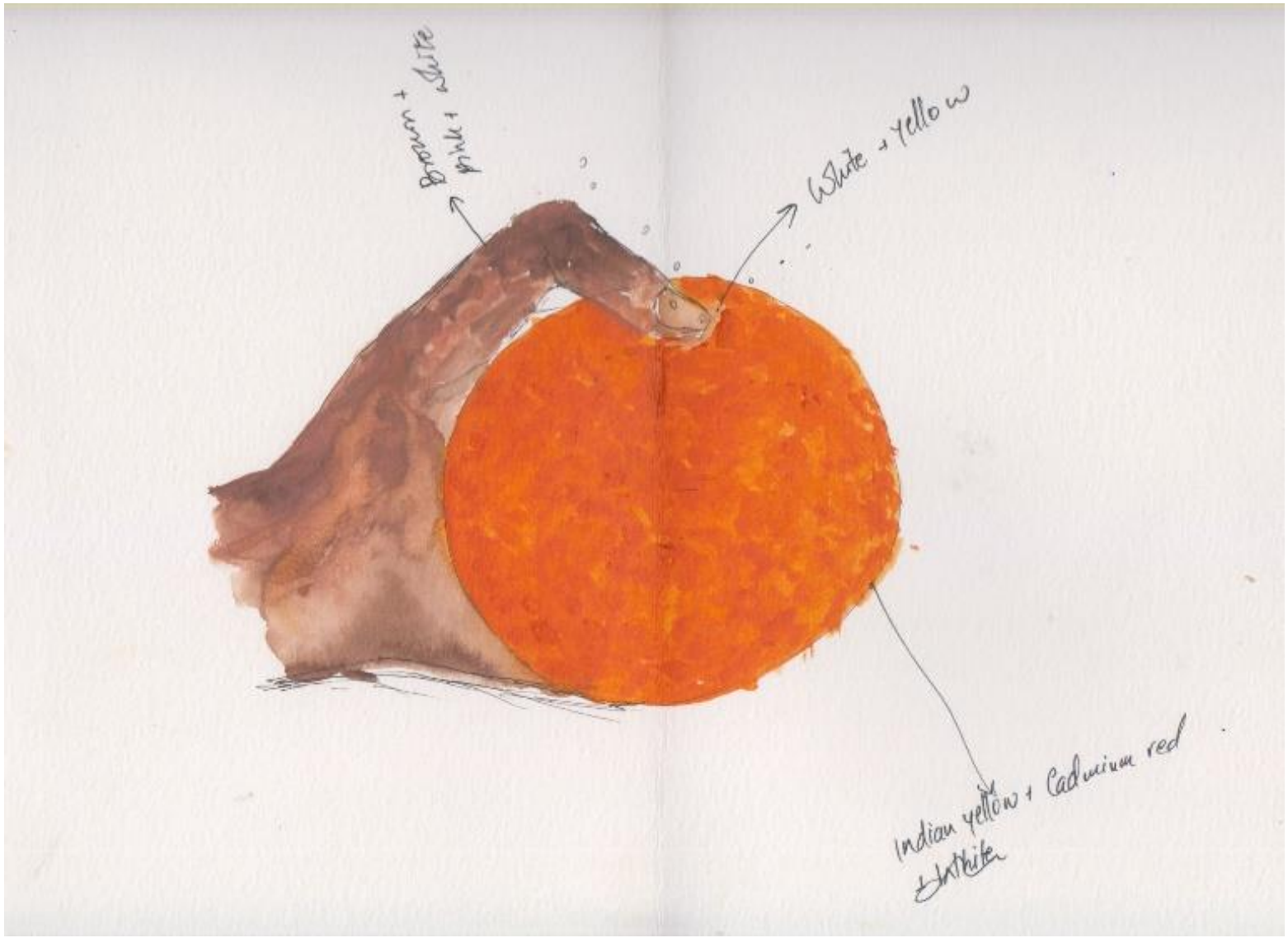
iii.


highlight
indian yellow +
cad. red
white + yell + red
red + white
yellow + green
base coat
orange
indian
yellow

iv.



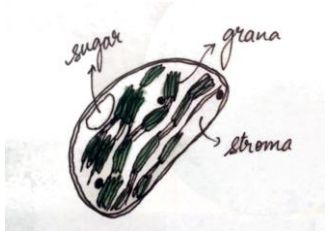
v.


Brown + white + pink
White + yellow
Indian yellow + Cadmium red + white

e. Science Note

Photosynthesis

Photosynthesis is the process through which special cells in plants and some other organisms capture light energy and pack it into chemical energy. The primary source of light energy is the sun. The cells store the chemical energy in sugars. These sugars are used by the plants to produce energy that they use to grow, form flowers, and produce fruit. All our food contains the energy that the special cells originally captured from the sun. These cells are special because they contain an organelle called the chloroplast.



The Chloroplast

The chloroplast is a cell organelle that is the site of photosynthesis. Chloroplasts are 1-2µm in size. 1 µm is 1/1000 of a centimeter. A chloroplast has two membranes and an inner folded membrane. The folded membrane makes discs called thylakoids. The thylakoids have fluid inside them and are stacked together to form grana. The grana are connected to each other by lamellae. The chloroplasts use light energy and carbon dioxide to make sugars. These sugars make droplets that we can see in the cell.

Chloroplasts are found in the cells of leaves in plants and green algae. In plants, the chloroplasts are found primarily in the mesophyll cells.

Palisade mesophyll cells

The palisade mesophyll cells are long, and pack ed close together. They use all the space they can, so they capture as much sunlight as possible. These cells are one of the special cells that contain chloroplasts.

Spongy mesophyll cells

The spongy mesophyll cells also contain chloroplasts. They are irregularly shaped and have lots of space between them. These spaces provide a way for the cells to take in and release gases. Just like palisade mesophyll cells are specialized to capture sunlight, spongy mesophyll cells are specialized to be the main sites of gas exchange. During photosynthesis, cells take in carbon dioxide and release oxygen gas.

Energy flow

The sun produces light energy in packets called photons. Chloroplasts use the energy in photons to make chemical energy. Chemical energy is stored in sugar packets. The sugar is used by the plant and herbivores directly. For example, bees collect nectar from the flowers, animals like giraffes and cows eat the leaves, and we humans eat the fruits. The nectar, leaves, and fruits contain the energy-rich sugars. Bees using this energy to buzz, cows to wander, and humans to write and draw.

References

1. Lambers, Hans, and James Bassham. 2018. "Photosynthesis | Importance, Process, & Reactions". *Encyclopedia Britannica*. https://www.britannica.com/science/photosynthesis.
2. "Chloroplast | Function, Location, & Diagram". 2018. *Encyclopedia Britannica*. https://www.britannica.com/science/chloroplast.
3. "The Chloroplast". 2018. *Ru.Ac.Za*. https://www.ru.ac.za/emu/temimages/thechloroplast/.
4. "Photosynthesis, Chloroplast | Learn Science At Scitable". 2018. *Nature.Com*. https://www.nature.com/scitable/topicpage/photosynthetic-cells-14025371.
5. "Spongy Mesophyll - Dictionary Definition Of Spongy Mesophyll | Encyclopedia.Com: FREE Online Dictionary". 2018. *Encyclopedia.Com*. https://www.encyclopedia.com/science/dictionaries-thesauruses-pictures-and-press-releases/spongy-mesophyll.
6. "BBC - Standard Grade Bitesize Biology - Making Food : Revision, Page 3". 2018. *Bbc.Co.Uk*. http://www.bbc.co.uk/bitesize/standard/biology/world_of_plants/making_food/revision/3/.
7. "Photosynthesis & Respiration". 2018. *Fruitandnuteducation.Ucdavis.Edu*. http://fruitandnuteducation.ucdavis.edu/generaltopics/Tree_Growth_Structure/Photosynthesis_Respiration.

Discussion

Prakriti and photosynthetic energy are thus presented in the book as entities with unique character. As seen above, *Prakriti* is presented as the sensory experience while observing oranges or dancing. Energy in photosynthesis is characterized in the book by the structures it inhabits: the leaves, cells, and chloroplasts, and then its products: the oranges. Thus, by describing attributes rather than defining each energy, the art and prose bring *Prakriti* and biological energy together in a real-life experience of science and the senses.

Rather than defining types of energy, the book describes them using sensory and observational art and prose. Just as the word 'photosynthesis' does not appear in the story section of the book, neither does *'Prakriti'.* However, defining *Prakriti* within the storyline as sensory energy that allows us to experience the smells and tastes describes could clarify the intention of the book to describe this form of energy. Further work to be done includes addition of a note describing *Prakriti* and its relevance to the book. The lack of definition in the book is debatable with regards to both the gaps it creates and the freedom it allows the reader. The compiled art forms the basis for further work on the book.

The transformation from decorative to informative art- from flat drawings to sketches with movement- depicts an important learning about the power of pictures in children's book to convey information such as the direction of the sunrise, the method of peeling an orange and the internal structure of a leaf. The choice of watercolour was maintained through the process.

Conclusion

A balanced combination of the Hindu philosophy and science was found in description of real-life processes and activities such as fruiting of orange trees and dancing. *Prakriti* and energy from photosynthesis can both be found in the oranges, but *Prakriti* is in the sensory experience, while the plant's energy is found in the observation of growth and fruit production. When the girls dance, their energy is from the sugars in the orange, while the dance itself is experienced through *Prakriti.* The compiled art submitted here will be further developed to produce finished pieces for the final book.

Annotated Bibliography

1. Kramrisch, Stella, and Praful C. Patel. *The Presence of Siva*. Motiala Banarsidass, 2007.

   Kramrisch draws on the Vedas, the primary religious texts in Hinduism, as her sources and makes their ideas accessible in English and to a novice in Hindu philosophy. The central idea of female energy and the opening prose above is based on the story of Parvathy as *Prakriti* as told in *The Presence of Siva.*

2. Thadani, N.V. *The Mystery of the Mahabharata Volume II.* Karachi, Bharat Publishing House, 1933.

   N.V. Thadani's book explains the many aspects of *Prakriti* as described in *Samkhya* philosophy. These ideas of *Prakriti* as the experienced energy of the world informed the basis of the storyline in the book.

3. Bang, Molly and Chisholm, Penny. *Rivers of Sunlight.* New York, The Blue Sky Press, 2017.

   Molly Bang's *Rivers of Sunlight* was a guide on the use of prose to supplement images with movement and wonder. *Rivers of Sunlight* is both scientifically sound and visually evocative of the water cycle. The prose also inspired the layout of sentences spread over two pages.

4. Groves, Julia. *Rainforest.* Swindon, UK: Child's Play Ltd., 2017.

   The end note on the Amazon rainforest in Julia Grove's *Rainforest* was the basis for the end note on photosynthesis. The notes give the reader a chance to look back at the book and connect information with the illustrations.

5. Burton, Virginia L. *The Little House.* Boston: Houghton Mifflin Harcourt, 1942.

   The Little House provided inspiration for the use of movement and stillness. The impact of the contrast between stillness and motion is very powerful in *The Little House,* and the illustrations further the story independently of the prose.

6. Pringle, Lawrence and Henderson, Meryl. *Spiders! Strange and Wonderful.* Honesdale, Pennsylvania: Boyds Mills Press, 2017.

   The book, *Spiders!* provided a good reference for the use of watercolour to create scientifically detailed and accurate images. The medium chosen for the book is watercolour, and so *Spiders!* was used to inform the level of detail, play of light/shadows with plants and insects, and show progression of events in nature as in the fruiting of the orange trees.

7. Bogan, Carmen and Cooper, Floyd. *Where's Rodney?* Dream on Publishing, 2017.

    The illustrations in *Where's Rodney?* use the entire page and show how text can be placed within the image to make the reading and understanding of the story flow smoothly, and how different amounts of text can be used at different places in the story to give the necessary amount of detail.

8. Martin, Jacqueline and McGehee, Claudia. *Creekfinding.* Minneapolis: University of Minnesota Press, 2017.

    Creekfinding showed how conversational prose can be injected with detailed information, as it tells a story from the third person while describing the features of the creek. The layout of the prose was variable according to the information and its specificity to the image.